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The American Midland Naturalist

Devoted to Natural History, Primarily that of the Prairie States

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The American Midland Naturalist

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Vol. XII MAY, 1931 No. 9

AN ANNOTATED LIST OF THE SNAILS OF ELLIS COUNTY, TEXAS[1]

ELMER P. CHEATUM AND CHARLES E. BURT

This report, which is based on collections made in Ellis County during the autumn of 1930, is our second contribution to the knowledge of the Gastropod fauna of Texas. Our first publication (1931) pertains to the snails of Dallas County, which borders Ellis County on the north, and includes a short review of the literature on Texas forms as well as a statement of the need for further surveys. In order to avoid duplication, our synonymy in this present article includes only citations not given previously.

A search of the literature fails to reveal published records of the occurrence of snails in Ellis County. Also, it seems of interest to note here that this present work includes seven species[2] not listed in our Dallas County report. Although in the majority of cases there was a striking correlation in the type of snail fauna in Ellis and Dallas counties when habitats

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[1] Joint contribution from the Department of Biology, Southern Methodist University, Dallas, Texas, and the Department of Biology, Trinity University, Waxahachie, Texas.

[2] These forms are: *Bulimulus patriarcha* Binney, *Euconulus chersinus chersinus* (Say), *Gastrocopta corticaria* (Say), *Pupisoma macneilli* (Clapp), *Succinea campestris* Say, *Strobilops hubbardi* (Brown), and *Gyraulus liebmanni* (Dunker).

were similar, but the densely wooded areas which are so ideal for snail life (especially for the representatives of the genus *Polygyra*) are less numerous in Ellis than in Dallas County.[3]

COLLECTING STATIONS

The 12 collecting stations described below have been selected so as to include a wide range of habitats. Soil data have been obtained in Bennet, Burke and Lounsbury's "Soil Survey of Ellis County, Texas" (1911).

STATION NO. 1.—This area borders Waxahachie Creek at a point 3 miles northwest of Waxahachie, where the soil consists of Houston Clay, Trinity Clay, and Houston Black Clay. Few living specimens were found here because of a scarcity of protective vegetation, but many shells were taken from piles of drift. An examination of the shallow stream and its limestone bed revealed only a few living examples of *Physa halei*.

STATION NO. 2.—This section borders Mustang Creek, 4½ miles northeast of Waxahachie, where the habitat, with reference to the lack of protective vegetation and the character of the stream, is similar to that of Station No. 1. Here the only collection was made in drift. The soil at this place is entirely of Houston Black Clay.

STATION NO. 3.—The Bell Branch Country Club, which is about 10 miles south of Waxahachie, is in a typically rolling country where the hillsides near a small artificial lake are covered with oak and hackberry trees. Here a dense covering of leaves and some rotting logs provide shelter for a number of minute forms as well as for certain larger ones. About the muddy shores of the lake three aquatic species were

[3] We wish to express our appreciation here to W. G. Clench for the identification of the forms referred to him, and to Edith Deck Cheatum and May Danheim Burt for other aid. The basic series of our snails from Ellis County is being added to the collections of Southern Methodist University and duplicate sets are being sent to the Museum of Comparative Zoology.

found. The soil in this environment is composed of Trinity Clay and Houston Stony Clay.

STATION NO. 4.—This collecting ground is 5 miles northwest of Waxahachie near a public highway where a number of limestone rocks are in evidence. Since trees are not present to furnish protection, only a few of the more widely distributed snails are found. Here the soil is made up of Houston Clay, Houston Stony Clay and Houston Black Clay.

STATION NO. 5.—This collecting site is two and one-half miles northwest of Waxahachie where the soil is formed by Houston Clay, Houston Black Clay, and Trinity Clay. Here abundant drift yielded a fairly good representation of the snail fauna of the region, including a number of the more minute species.

STATION NO. 6.—This area is 3 miles east of Waxahachie where the soil is composed entirely of Houston Black Clay. A small flow of water over the flat foundation under a cement bridge in this vicinity was found to support a growth of algae over which a large number of *Physa halei* and *Physa anatina* were browsing. A small stream below this point is bordered by a light covering of vegetation which protects certain of the more abundant forms of land snails.

STATION NO. 7.—This vicinity is 3 miles southeast of Midlothian where a variegated soil of Crawford Clay Loam and Houston Stony Clay is found. Here a fairly dense growth of elm, oak and hackberry towers above a layer of partially decayed organic matter, a certain amount of drift, and some rotting logs. In this environment not only the common large species, but many minute ones were easily obtained, both in the living and in the dead state. Because of the favorable nature of this habitat a greater variety of snails were secured here than at any other collecting station.

STATION NO. 8.—This spot is 8 miles northeast of Midlothian where a small stream meanders through low undulating hills that show many outcroppings of limestone rocks.

Several *Physa anatina* were taken in the stream itself, but only a few land snails were secured in drift on the banks. The soil in this section is composed of Houston Stony Clay and Houston Black Clay.

STATION NO. 9.—This plot lies 7 miles northwest of Waxahachie where a grove of hackberry and oak grows from a soil of Houston Clay. The low land at this point is probably flooded after every heavy rain, for an abundance of débris is in evidence. Here many dead shells and several living individuals of the genus *Succinea* were found beneath a mat of dried and decaying leaves.

STATION NO. 10.—This collecting field consists of a coniferous grove, which is adjacent to a small creek 10 miles northeast of Midlothian, where the soil is composed of Ellis Clay and Houston Black Clay. The earthen floor beneath the trees is covered by a thick layer of twigs, leaves, pine needles, and rotting logs which harbors a rather wide variety of snails, including representatives of several minute species. Many of these, especially those occurring under rotting logs, were alive and active since sufficient moisture was retained to meet their physiological requirements.

STATION NO. 11.—At this place, which is approximately 4 miles east of Telico, a rather large and heavy growth of deciduous trees borders the Trinity River and the soil is entirely of Trinity Clay. Under the trees close to the river bank are mats of leaves and rotting logs in abundance. Such an environment should seemingly provide shelter for a large number of species, but with the exception of *Polygyra texasiana* and *Vitrea indentata*, which occurred frequently, few forms of snails were found. To add to this disappointment, even the drift in this vicinity was surprisingly barren, yielding only a few dead shells of the more abundant and generally distributed species.

STATION NO. 12.—Waxahachie Creek flows through Getzendaner Park in Waxahachie. In this vicinity the soil consists

of Trinity Clay and Houston Clay. The banks of the creek are heavily wooded for a distance of several hundred yards and a profusion of rotting logs, considerable drift, and a mat of dried and decaying leaves supports an abundance of snail life. Here many living land snails were secured and in addition a number of water snails were found in the creek itself as they were crawling about or clinging to the dead leaves that had fallen into the water.

LIST OF SPECIES

Class Gastropoda
Subclass Streptoneura
Order Prosobranchiata
Suborder Taenioglossa
Family Helicinidae
Genus *Helicina* Lamarck

Helicina orbiculata (Say)

This interesting species has a general distribution over the county and was found at all of our collecting stations. In favorable habitats the ground is literally covered by its dead shells.

Records.—All stations.

Subclass Euthyneura
Order Pulmonata
Suborder Stylommatophora
1. Sigmurethra
Superfamily Holopoda
Family Helicidae
Genus *Polygyra* Say

Polygyra albolabris albolabris (Say)

This snail is confined to the more heavily wooded regions where only a very few specimens were collected. The majority of these were dead shells.

Records.—Stations 6 and 7.

Polygyra monodon fraterna (Say)

Only one dead shell of this species was collected in the valley of the Trinity River. In Dallas County in a similar habitat many shells of this species have been taken.

Record.—Station 11.

Polygyra roemeri (Pfeiffer)

This species occurs in similar habitats to *albolabris* and *thyroidus*. However, it is a hardier snail than the other two since it is found in more open habitats.

Records.—Stations 6, 7, and 12.

Polygyra texasiana (Moricand)

This species has a general distribution over the county, occurring regularly in favorable environments.

Records.—Stations 1, 2, 3, 6, 7, 8, 9, 10, 11 and 12.

Polygyra thyroidus (Say)

This form is often found in habitats similar to those occupied by *Polygyra albolabris albolabris* and *P. roemeri*.

Records.—Stations 6 and 12.

Family Bulimulidae

Genus *Bulimulus* Leach

Bulimulus dealbatus (Say)

This large land snail is probably the most common gastropod in Ellis County, since it occurs abundantly in a wide variety of habitats.

Records.—Stations 1, 2, 3, 4, 5, 6, 7, 11 and 12.

Bulimulus patriacha Binney

Bulimulus patriarcha Binney, Proc. Acad. Nat. Sci., Phila., 1858, p. 116, (type locality, Buena Vista, Mexico).

We refer only one young specimen to this species; it exhibits the characteristics specified by Binney (1885, p. 396) for this form.

Record.—Station 7.

Superfamily Aulacopoda

Family Zonitidae

Genus *Vitrea* Fitzinger

Vitrea indentata (Say)

The shell of this common species is found to be larger, but thinner and more pellucid, in heavily wooded areas.

Records.—All stations.

Genus *Euconulus* Reinhardt

Euconulus chersinus chersinus (Say)

Helix chersina Say, Journ. Acad. Nat. Sci., Phila., Vol 2, 1821, p. 156, (type locality, Sea Islands of Georgia).

Euconulus chersinus Wheeler, Nautilus, Vol. 25, 1912, p. 125.

This subspecies differs from the allied *polygyratus* in the greater elevation of the spire. Only eight of these shells have been collected in Ellis County.

Record.—Station 7.

Euconulus chersinus polygyratus (Pilsbry)

Living snails of this species were found only at Station 12, but a considerable number of dead shells were collected in drift in two other locations.

Records.—Stations 1, 2, and 12.

Genus *Zonitoides* Lehmann

Zonitoides arboreus (Say)

This form is frequently associated with *Zonitoides singleyanus* and *Vitrea indentata.* It is a widely distributed snail and one that reaches its maximum size in heavily wooded regions, although it is also found on barren hillsides under limestone rocks.

Records.—Stations 2, 7, 9, 11 and 12.

Zonitoides singleyanus (Pilsby)

A number of dead shells of this species were found in drift but very few living specimens were taken.

Records.—Stations 2, 5, 7, 10 and 12.

Family Endodontidae

Genus *Anguispira* Morse

Anguispira alternata carinata (Pilsbry and Rhoads)

One shell of this subspecies was found in a pile of drift.
Record.—Station 12.

Genus *Gonyodiscus* Fitzinger

Gonyodiscus cronkhitei anthonyi (Pilsbry)

Three bleached shells of this subspecies were secured in drift.
Record.—Station 7.

Genus *Helicodiscus* Morse

Helicodiscus parallelus (Say)

Dead shells of this form were found in drift and, in addition, living examples were secured under rotting logs in damp situations.
Records.—Stations 7, 10 and 12.

Superfamily Agnathomorpha
Genus *Haplotrema* Ancey

Haplotrema concava (Say)

Only a few dead shells ofthis form were secured in drift.
Records.—Stations 1 and 10.

Superfamily Orthurethra
Family Pupillidae
Genus *Gastrocopta* Wollaston

Gastrocopta armifera armifera (Say)

Shells of this subspecies were collected in drift and a few living individuals were found under leaves.
Records.—Stations 1, 2 and 7.

Gastrocopta contracta contracta (*Say*)

A series of the shells of this snail were taken in similar habitats to *armifera*.
Records.—Stations 1, 7 and 10.

Gastrocopta corticaria (Say)

Odostomia corticaria SAY, in Nicholson, Encyclopedia of Arts and Sciences, Vol. 4, 1817, "Conchology," (No pagination), pl. 4, fig. 5, (type locality, not specified).

Gastrocopta corticaria PILSBRY, Man. Conch., Vol. 24, 1916, p. 52, pl. 10, figs, 1-4.

In one habitat a few dead specimens of *corticara* were collected in drift and in another place three living ones were found beneath a mat of leaves which was two or three inches in thickness.

Records.— Stations 2 and 7.

Gastrocopta pentodon pendoton (Say)

Our specimens of this subspecies were secured in drift.

Record.—Station 7.

Genus *Pupoides* Pfeiffer

Pupoides marginatus (Say)

Both living specimens and dead shells of this species were found in drift.

Record.—Station 1.

Pupisoma macneilli (Clapp)

Thysanophora macneilli Clapp, Nautilus, Vol. 31, 1918, p. 74, pl. 8, fig. 1, (type locality, Magazine Point, 8 miles north of Mobile, Alabama.

Pupisoma macneilli PILSBRY, Man. Conch., Vol. 26, 1920, p. 41, pl. 4, fig. 15.

Bleached shells of this species were obtained only in drift in a relatively exposed place. They were darker than those examples mentioned in the original description.

Record.—Station 1.

Genus *Columella* Westerlund

Columella edentula (Draparnaud)

Several representatives of this species were gathered in drift.

Records.—Stations 2 and 12.

Family Strobilopsidae

Genus *Strobilops* Pilsbry

Strobilops hubbardi (Brown)

Helix hubbardi BROWN, Proc. Acad. Nat. Sci. Phila.,

1861, p. 333, (type locality, Indianola, Calhoun County, Texas).

Strobilops hubbardi PILSBRY, Man. Conch., Vol. 28, 1927, p. 47, pl. 7, fig. 1-3.

This species is supposed to be purely southern and according to Binney (1885, p. 360) it belongs to the Mexican fauna. Several living specimens and a few dead shells of this species were collected.

Records.—Stations 1 and 7.

Strobilops labyrinthica labyrinthica (Say)

This species is particularly common in drift along Waxahachie Creek.

Records.—Stations 1, 7, 10 and 12.

Strobilops texasiana floridana (Pilsbry)

This subspecies is very frequently found to be associated with the preceding form.

Records.—Stations 1, 5, 7, and 12.

II. Heterurethra
Superfamily Elasmognatha
Family Succineidae
Genus *Succinea* Draparnaud

Succinea avara Say

This species was found in a moist habitat, beneath decaying logs.

Records.—Stations 1 and 12.

Succinea campestris Say

Succinea campestris SAY, Jour. Acad. Nat. Sci. Phila., Vol. 1, 1817, p. 281, (type locality, eastern Florida).

Only two dead shells of this species were collected in a low region, which was dry at the time of our visit. Binney (1885, p. 414) stated that this species had been observed only in Florida and Georgia, yet our two shells fit his description admirably.

Record.—Station 9.

Succinea grosvernori Lea

This is no doubt the most common representative of its genus in Ellis County, occuring frequently under mats of leaves.

Records.—Stations 1, 4, 7, 9 and 10.

Suborder Basommatophora
Superfamily Limnophila
Family Lymnaeidae
Genus *Galba* Shrank

Galba bulimoides techella (Haldeman)

This subspecies was secured near the edge of Waxahachie Creek where it was attached to leaves that had been blown into the water.

Record.—Station 7.

Family Planorbidae
Genus *Gyraulus* Charpentier

Gyraulus parvus (Say)

Dead shells of *parvus* were obtained near the muddy margin of the artificial lake at the Bell Branch Country Club, south of Waxahachie.

Record.—Station 3.

Gyraulus liebmanni (Dunker)

Hundreds of dead shells of this form were found in the same habitat as *parvus*, but an intensive search along the shores of this small lake failed to reveal a single living individual.

Record.—Station 3.

Genus *Helisoma* Swainson
Helisoma lentus (Say)

This common inhabitant of Texas water courses was obtained in the same general habitat as the physid snails listed beyow.

Records.— Stations 3, 7 and 12.

Family Physidae
Genus *Physa* (Draparnaud)

Physa halei Lea

This snail is commonly found in the streams of Ellis County, particularly in well oxygenated places. At Station No. 6 it was observed feeding upon masses of green algae which were growing over the flat slab of a cement foundation under a bridge.

Records.—Stations 1, 3, 6, 7 and 12.

Physa anatina Lea

This species was found closely associated with *Physa halei* although it is much less abundant than the former.

Records.—Stations 3, 6, 7 and 8.

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GAUDRYINELLA, A NEW FORAMINIFERAL GENUS

BY HELEN JEANNE PLUMMER

Test elongate, adventitious; early chambers triserial, later chambers biserial from a few compact textularian series through a succession of fully mature chambers that tend toward uniseriality and may in fullest development reach a perfect uniserial stage; aperture verneuiline in initial stage, textularian in earliest biserial chambers, a large round or broadly elliptical orifice in full maturity above the base of the final chamber and becoming more and more nearly terminal with advanced age, terminal on late uniserial chambers.

Holotype, *Gaudryinella delrioensis* n. sp.

In species of *Gaudryina* the mature biserial chambers are characterized by the typical textularian aperture, a low or moderately high and arched orifice at the base of the septal face and lying on the penultimate chamber. In species of this genus the mature biserial chambers following the youthful triserial stage are less compact and are characterized by the round aperture that lies above the base of the septal face. Rare senile tests may exhibit one or more uniserial chambers with a round or broadly elliptical and almost terminal opening. Such senile chambers do not necessarily constitute an essential feature of this genus, but it is an expression of inherent potentialities that become the diagnostic character of *Clavulina*, in which the biserial stage is skipped or almost eliminated from the structure through rapid acceleration in its development from its earliest stage to the mature uniserial chambers.

GAUDRYINELLA **DELRIOENSIS** n. sp.

FIGURE 1, a, b.

Textularia sp. Margaret Carpenter, 1925, Univ. Texas Bull. 2544, pl. 17, fig. 18.

Test small, very slender, rather coarsely agglutinate for its size and composed of minute calcareous granules; earliest chambers in a compact triserial succession comprising a small

and bluntly rounded or slightly pyramidal initial extremity; later chambers biserial grading from an early compact structure of a few rounded chambers through numerous chambers that in their arrangement tend more and more toward a rectilinear series and become bluntly quadrate posteriorly; senile chambers truly uniserial; sutures very distinct throughout growth and deeply incised between mature chambers; aperture a round opening at the base of the septal face throughout its biserial development and becoming more and more nearly terminal with growth, wholly terminal on uniserial chambers of very late maturity.

Length up to 1 mm.; average length .6 mm.

Gaudryinella delrioensis n. sp. at its type locality reaches the extreme uniserial development. Wherever it has been observed the test exhibits its characteristically loosely biserial chambers very early in the biserial stage with the high, large, round aperture that become very nearly terminal even before the uniserial chambers are attained.

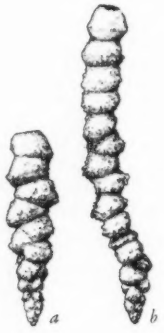

FIG. 1. *Gaudryinella delrioensis* n. sp., x 50. *a*, Holotype, showing average development of a mature test. *b*, Paratype, showing a very senile test with several uniserial chambers.

The Del Rio formation of central Texas, and the equivalent Grayson formation of north Texas carry this species in considerable frequency. It has been observed also as a rare form in faunas of the Duck Creek, Fort Worth, Weno, and Pawpaw formations in north Texas.

Holotype and paratype (Plummer Coll. S-770.1, S-770.2) from Del Rio formation, Lower Cretaceous, in right bank of Shoal Creek, at west end of 34th Street bridge in Austin, Texas. Metatypes in Notre Dame University, University of Buffalo, Bureau of Economic Geology of Texas, Cushman Collection, U. S. National Museum, British Museum.

FRANCIS DANIELS' GRASSES

BY BENJAMIN FRANKLIN BUSH

In a previous issue of this magazine[1] I have given an account of an examination of the *Carex* specimens upon which Francis Daniels[2] based his species of *Carex* in his Flora[3], and I am now able through the kindness of Mr. H. W. Rickett, custodian of the Herbarium of the University of Missouri, to present a like treatment of the species and varieties of grasses collected and studied by Daniels.

A careful examination of Daniels' list of species and varieties of *Panicum* by any one familiar at all with the Missouri Flora will show that more than one-half of his names can not stand as Boone County species.

Much of the activity in the study of *Panicum* species was between 1895 and 1905, so it is quite apparent that Daniels did not prepare his list in accordance with the latest understanding of the species.

Some new changes in the nomenclature of the species have been made, and several species have had their ranges amended, but otherwise the names of the species as a whole have remained about as Daniels knew them.

I have retained Daniels' generic and specific names, and his numbers, in the order given in his Flora, that reference to the species may be the more readily made, and have made notations on his species wherever it appeared necessary.

There are 42 genera and 122 species and varieties of grasses in Daniels' Flora, something less than one-half of the species known for the State, but I found only 74 species and varieties in the collection.

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1 The Am. Midland Naturalist *12;* No. 7. 1931.

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2 *Daniels, Francis Potter,* born Ionia, Michigan, August 1, 1869; father, Newton Russell Daniels; mother, Rosina Frances Potter; A. B., Univ. of Michigan, 1896; Ph.D., Univ. of Missouri, 1905; Teaching Fellow, Univ. of Missouri, 1896-97.

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3 The Flora of Columbia, Missouri, and Vicinity, p. 319, Jan., 1907.

I have, however, found three genera that Daniels lost and a number of species in the collection that he did not recognize or collect, or have been collected in Boone County since he published his Flora, or else overlooked when he prepared his manuscript, bringing the number of genera up to 40, and the number of species and varieties up to 104, for Boone County.

I am under obligations to Prof. Hitchcock, of the National Herbarium, who has examined and reported on a number of doubtful specimens.

32. ZEA MAYS L. 1753.

No specimens seen in the Daniels' collection, or in the University collection, but as this species is found adventive in many places in the State, it is almost certain that Daniels observed it in Boone County.

33. TRIPSACUM DACTYLOIDES L. 1763.

Common to all prairie regions of the State, in swales. Columbia, *Daniels*, July 1903, five sheets; Jackson County, *Bush* July 6, 1892.

34. ANDROPOGON SCOPARIUM Michx. 1803.

Columbia, *Daniels*, August, 1904, *Saeger*, August 18, 1919; Carl Junction, *Palmer* 32746, September 15, 1927; Jackson County, *Bush*, October 2, 1892, as *A. scoparius multiramea; Bush*, August 31, 1891.

35. ANDROPOGON FURCATUM Muhl. 1806.

Columbia, *Saeger*, August 18, 1919; *Daniels*, August 1904; Webb City, *Palmer* 32543, August 17, 1927; Columbia, *Stone*, October 28, 1901, as *A. Hallii;* Jackson County, *Bush*, August 23, 1890; McDonald County, *Bush*, August 2, 1892, as *A. Hallii.*

36. *Andropogon* Hallii Hack. 1884.

No specimens of this species under any name were found in the Daniels collection or from Boone County.

37. ANDROPOGON HALEPENSIS (L.) Brot. 1804.

Sometimes planted for forage, and becoming adventive

along railroads, is waste places and in fields, and undoubtedly seen by Daniels in Boone County.

38. ANDROPOGON SORGHUM VULGARIS (Pers.) Hack.

Commonly cultivated for syrup and feed, and now becoming adventive in waste places, along railroads and in fields, and no doubt observed by Daniels in Boone County.

39. *Andropogon avenaceus* Michx. 1803.

No specimens of this species under any name were found in the Daniels' collection, or in the University collection from Missouri.

40. *Paspalum setaceum* Michx. 1803.

No specimens of this species under any name were found in the University collection from Missouri.

41. PANICUM FILIFORME L. 1753.

Columbia, *Daniels*, September 13, 1902; Jackson County, *Bush*, August 10, 1883; McDonald County, *Bush*, July 24, 1892.

42. PANICUM SANGUINALE L. 1753.

Columbia, *Daniels*, August, 1904; *Saeger*, July 19, 1919; *Dickson*, August 15, 1927, two sheets; Bolivar, *Hoover*, 1899; Jackson County, *Bush*, August 23, 1891.

43. PANICUM CRUS-GALLI L. 1753.

Columbia, *Daniels*, July 1903, two sheets; *Reed*, September 24, 1903, as *Echinochloa Crus-galli mutica; Daniels*, August, 1902; *Saeger*, August 11, 1919; *Daniels*, July 17, 1903, as *Echinochloa Crusgalli hirsutum*, two sheets; *Dickson*, August 15, 1927; Rocheport, *Rickett*, September 27, 1929; Wellington, *Bush*, 11526, September 3, 1927, as *Echinochloa muricata;* Jackson County, *Bush*, August 26, 1888, as *Echinochloa Crus-galli hirsutum; Bush*, September 1, 1888, as *Echinochloa Crus-galli muticum; Bush*, August 26, 1890.

44. PANICUM CAPILLARE L. 1753.

An abundant species in fields and woods, and along bottoms, but apparently collected but once by Daniels. Columbia,

Daniels, September, 1902 two sheets; Jackson County, *Bush* August 23, 1891; Lees Summit, *Bush* 11542, September 13, 1927.

45. PANICUM GATTINGERI Nash, 1903.

Columbia, *Daniels*, September, 1902, two sheets, as *P. flexile; Daniels*, September, 1903 and September, 1904.

46. *Panicum flexile* (Gatt.) Scribn. 1893.

Columbia, *Daniels*, July 11, 1903 *P. capillare; Daniels*, August 1904, as *Eragrostis capillaris; Saeger*, September 5, 1919. No specimen so named by Daniels was found in the University collection.

47. PANICUM VIRGATUM L. 1753.

Columbia, *Daniels*, September, 1904; McDonald County, *Bush*, July 24, 1892, as *P. virgatum molle;* Jackson County, Bush, August 7, 1891, Shannon County, *Bush*, September 12, 1888, as *P. virgatum pauciflorum.*

48. *Panicum proliferum* Lam. 1797.

Columbia, *Daniels*, September, 1904, and September, 1902, two sheets; Columbia, *Favor*, September 23, 1901, two sheets; Columbia, *Saeger*, August 23, 1919, as *P. dichotomiflorum;* Jackson County, *Bush*, August 23, 1891.

49. *Panicum perlongum* Nash, 1899.

No specimens of this species under any name were found in the Daniels' collection, but the University collection contains the following: Shannon County, *Bush*, June 1, 1890, as *P. depauperatum.*

50. PANICUM ENSLINII Trin. 1826.

Columbia, *Daniels*, July 9, 1903, two sheets, as *P. linearifolium;* Columbia, *Daniels*, July, 1904, four sheets, as *P. perlongum.*

51. *Panicum depauperatum* Muhl. 1817.

No specimens under any name were found in the University collection.

52. *Panicum columbianum* Scribn. 1897.

No specimens under any name were found in the University collection.

53. *Panicum implicatum* Scribn. 1898.

No specimens so named were found in the Daniels' collection but there is one; Columbia, *Daniels*, June 1903, as *P. dichotomum villosum;* Webb City, *Palmer* 21573, May 29, 1922, as *P. implicatum.*

Panicum dichotomum L. 1753.

Three small culms are referred to this species by Hitchcock as follows: Columbia, *Daniels*, June 1903, as *P. dichotomum villosum*, but no specimen found in the University collection to support Daniel's identification in his flora.

54A. *Panicum dichotomum fasciculatum* S. Wats. 1890.

No specimens under any name were found in the University collection.

54B. *Panicum dichotomum commune* S. Wats. 1890.

No specimens of this variety under any name were found in the University collection.

54C. *Panicum dichotomum gracile* S. Wats. 1890.

No specimens of this variety under any name were found in the University collection.

54D. *Panicum dichotomum villosum* Vasey, 1889.

No specimens of this variety under any name were found in the University collection.

55. *Panicum nitidum* Lam. 1797.

No specimens of this species under any name were found in the Daniel's collection, but there is one in the Missouri collection as follows: Louisiana, *Fritchey* 90, no date, as *P. dichotomum.*

56. *Panicum lanuginosum* Ell. 1817.

No specimens of this species under any name were found in the University collection.

57. *Panicum commutatum* Schultes, 1824.

No specimens of this species under any name were found in the Daniel's collection: there is a specimen in the Missouri collection as follows: Dunklin County, *Bush*, October 23, 1892, as *P. commutatum*.

58. PANICUM PORTERIANUM Nash, 1895.

Columbia, *Daniels*, July 17, 1903.

59. *Panicum pubifolium* Nash, 1899.

No specimens of this species under any name were found in the University collection.

60. PANICUM CLANDESTINUM L. 1753.

Columbia, *Daniels*, July 13, 1903, two sheets, and July 21, 1903; Columbia, *Daniels*, July 17, 1903, as *P. Porterianum;* Columbia, *Daniels*, August, 1904; Wellington, *Bush* 11525, September 3, 1927; Oronogo, *Palmer* 31486, August 23, 1926.

From the above it may be noted that Daniels really had only seven species of *Panicum* in his collection as distinguished by him, fourteen of his names not being represented by any specimens so named by him.

However, I have found in the Daniel's collection several species and varieties not distinguished by him, and I append a list of them that the Boone County list may be brought up to date.

61. *Setaria glauca* (L.) Beauv. 1812.

Columbia, *Daniels*, August, 1904; *Saegers*, July 20, 1919; Asbury, *Palmer* 33192, October 28, 1927; Jackson County, *Bush*, August 23, 1891.

62. SETARIA VIRIDIS (L.) Beauv. 1812.

Columbia, *Daniels*, July, 1903, two sheets; *Dickson*, August 15, 1927, two sheets; *Rickett*, June 23, 1929; Jackson County, *Bush*, July 10, 1891.

63. SETARIA ITALICA (L.) Beauv. 1812.

Columbia, *Daniels*, July, 1904.

64. *Setaria verticillata* (L.) Beauv. 1812.

No specimens of this species under any name were found in the Daniel's collection, but there are two collections in the University collection. Columbia, *Duggar*, July 20, 1903; Jackson County, *Bush*, June 25, 1891.

65. CENCHRUS TRIBULOIDES L. 1753.

Columbia, *Daniels*, July, 1903, two sheets; Columbia, *Saeger*, August 12, 1919; Commerce, *Kincaid*, August 23, 1927; Sinking Creek, *Rickett*, September 2, 1929; Jackson County, *Bush*, August 26, 1890.

66. LEERSIA VIRGINICA Willd. 1797.

Columbia, *Daniels*, July 30, 1903, two sheets; *Daniels*, August, 1902; *Galloway*, August 1, 1884; Boone County collector and date not given; *Saeger*, September 9, 1919; Jackson County, *Bush*, August 24, 1891.

67. LEERSIA ORYZOIDES (L.) Swartz, 1788.

Columbia, *Daniels*, September, 1904; *Saeger*, September 27, 1919; Webb City, *Palmer* 32797, September 24, 1928; Jackson County, *Bush*, August 24, 1891.

68. *Aristida basiramea* Engelm. 1884.

No specimens of this species under any name were found in the Daniel's collection, but there is one in the University collection as follows: Saint Louis County, *Eggert*, August 16, 1874.

69. ARISTIDA OLIGANTHA Michx. 1803.

Columbia, *Daniels*, September, 1902, two sheets; *Daniels*, July 17, 1902; *Galloway*, August 1, 1884; *Favor*, August 29, 1903; *Howard*, October 4, 1900; *Saeger*, August 8, 1919.

70. MUHLENBERGIA SOBOLIFERA (Muhl.) Trin. 1824.

Columbia, *Daniels*, September 26, 1902, two sheets; *Daniels*, July 30, 1903; *Saeger*, September 11, 1919; Jackson County, *Bush*, September 15, 1890; Less Summit, *Bush*, 11543, September 13, 1927.

71. MUHLENBERGIA MEXICANA (L.) Trin. 1824.

Columbia, *Daniels*, August, 1904; *Saeger*, September 10, 1919; Jackson County, *Bush*, August 30, 1891; Jasper, *Palmer* 32676, August 30, 1897; Webb City, *Palmer* 32734, September 15, 1927; Louisiana, *Fritchey*, date not given; Jackson County, *Bush*, September 18, 1887, as *M. mexicana filiformis*.

72. *Muhlenbergia racemosa* (Michx.) B. S. P. 1888.

No specimens of this species under any name were found in the Daniel's collection or from Boone County, but there are two collections as follows: Jackson County, *Bush*, August 24, 1891; *Bush*, August 26, 1890, as *M. glomerata ramosa*.

73. *Muhlenbergia sylvatica* Torr. 1840.

No specimens of this species under any name were found in the University collection from Boone County, but there is one Missouri collection as follows: Independence, *Bush*, September 11, 1884.

74. *Muhlenbergia tenuiflora* (Willd.) B. S. P. 1888.

Columbia, *Daniels*, September, 1904; *Saeger*, September 11, 1919, as *M. sylvatica;* Saint Louis County, *Eggert*, August 3, 1877; Jackson County, *Bush*, August 24, 1891, as *M. sylvatica*.

75. MUHLENBERGIA DIFFUSA Willd. 1798.

Columbia, *Daniels*, October 1, 1901; *Daniels*, September, 1905; *Daniels*, August 20, 1902, as *M. sylvatica; Saeger*, September 9, 1919; Jackson County, *Bush*, August 24, 1891; Bolivar, *Hoover*, 1899.

76. BRACHYELYTRUM ARISTATUM (Schreb.) R. & S. 1817.

Columbia, *Daniels*, June, 1897; *Daniels*, July 13, 1903; *Daniels*, July 17, 1903; McDonald County, *Bush*, July 24, 1892.

77. PHLEUM PRATENSE L. 1753.

Columbia, *Daniels*, July 3, 1903; Boone County, collector not given, October 18, 1898; Jackson County, *Bush*, August 24, 1891.

78. *Alopecurus pratensis* L. 1753.

No specimens of this species under any name were found in the Daniel's collection, but there is one from Boone County, as follows: Columbia, *Saeger*, May 27, 1920.

79. *Alopecurus geniculatus* L. 1753.

No specimens of this species under any name were found in the *Daniels* collection, but there are two collections as follows: Columbia, *Saeger*, May 18, 1920; Jackson County, *Bush*, June 5, 1891.

79A. ALOPECURUS GENICULATUS FULVUS (J. E. Smith) Scribn.

Columbia, *Daniels*, July, 1903; Saint Louis County, *Eggert*, May 15, 1892; Jackson County, *Bush*, May 12, 1890.

80. SPOROBOLUS VAGINAEFLORUS (Torr.) Wood, 1861.

Columbia, *Daniels*, September 13, 1902; Webb City, *Palmer* 32930, September 15, 1927; Smithfield, *Palmer* 32770, September 20, 1927; Saint Louis County, *Eggert*, September 15, 1891.

81. *Sporobolus cuspidatus* (Torr.) Wood, 1861.

No specimens of this species under any name were found in the Daniel's collection or from Boone County, but there is one collection as follows: Noel, *Palmer* 20545, September 21, 1921.

82. CINNA ARUNDINACEA L. 1753.

Columbia, *Daniels*, September 23, 1901; *Daniels*, September, 1904; *Favor*, September 23, 1901, two sheets; *Saeger*, September 27, 1919; Jackson County, *Bush*, August 30, 1891.

83. AGROSTIS ALBA L. 1753.

Columbia, *Daniels*, July 3, 1903; *Rickett*, July 3, 1930, two sheets; Bolivar, *Hoover*, 1899, as *A. intermedia*.

84. AGROSTIS VULGARIS With. 1796.

Columbia, *Daniels*, July 30, 1903; Jackson County, *Bush*, July 3, 1891.

85. *Agrostis perennans* (Walt.) Tuckerm. 1843.

No specimens of this species under any name were found in the Daniels collection, but there are three sheets in the Missouri collection as follows: Columbia, *Rickett*, June 29, 1930, as *Glyceria nervata* in part; Bolivar, *Hoover*, 1899, two sheets.

86. AGROSTIS HYEMALIS (Walt.) B. S. P. 1888.

Columbia, *Daniels*, May, 1897; *Daniels*, June 13, 1903; Bolivar, *Hoover*, 1899; Jackson County, *Bush*, July 15, 1892.

87. AVENA SATIVA L. 1753.

Columbia, *Daniels*, July 3, 1903.

88. *Arrhenatherium avenaceum* Beauv. 1812.

No specimens of this species under any name were found in the University collection from Missouri.

89. DANTHONIA SPICATA (L.) Beauv. 1817.

Columbia, *Daniels*, June 13, 1903; *Rickett*, June 23, 1929; Wright County, *Bush*, June 25, 1888; Monterey, *Rickett*, June 5, 1930; Reynolds County, *Tracy*, June 9, 1886.

90. SPARTINA CYNOSUROIDES (L.) Roth, 1806.

Columbia, Daniels, July, 1903; *Galloway*, August 1, 1884. Saeger, August 18, 1919; Jackson County, *Bush*, August 30, 1891.

91. SCHEDONNARDUS PANICULATUS (Nutt.) Trel. 1891.

Columbia, *Daniels*, July 4, 1904, two sheets; Jackson County, *Bush*, July 19, 1892.

92. BOUTELOUA RACEMOSA Lag. 1805.

Columbia, *Daniels*, July, 1903; *Tracy*, August 1, 1884; Shannon County, *Bush*, July 16, 1891.

93. ELEUSINE INDICA (L.) Gaertn. 1788.

Columbia, *Daniels*, May 19, 1902; *Daniels*, June, 1897; *Saeger*, August 17, 1919; *Duggar*, July 19, 1903; Boone County, *Tracy*, date not given; Boone County, collector not given, October 13, 1898; Bolivar, *Hoover*, 1899; Jackson

County, *Bush*, September 15, 1891; Clinton, *Link*, July 1, 1892.

94. TRIODIA CUPREA Jacq.

Columbia, *Daniels*, August, 1897; *Daniels*, September 13, 1902, two sheets; *Saeger*, August 10, 1919; *Rickett*, August 16, 1927; *Favor*, September 23, 1901; Jackson County, *Bush*, August 23, 1891.

95. ERAGROSTIS CAPILLARIS (L.) Nees. 1829.

Columbia, *Daniels*, July 26, 1903; *Daniels*, August, 1904; *Daniels*, August, 1897, as *E. tenuis; Daniels*, July 29, 1903, as *E. pilosa; Daniels*, August, 1897, as *Panicum capillare flexile; Saeger*, August 12, 1919; Oregon County, *Bush*, August 14, 1892.

96. ERAGROSTIS FRANKII Steud. 1855.

Columbia, *Daniels*, August 20, 1903; October 1, 1901; August, 1897; *Daniels*, August, 1903; *Daniels*, September 13, 1902, as *E. pilosa;* Jackson County, *Bush*, August 23, 1891.

97. ERAGROSTIS PILOSA (L.) Beauv. 1812.

Columbia, *Daniels*, July 29, 1903; Webb City, *Palmer* 32593, August 20, 1927.

98. ERAGROSTIS PURSHII Schrad. 1838.

Columbia, *Daniels*, August, 1903; *Daniels*, 1897; *Daniels*, July 27, 1903; *Saeger*, July 23, 1919, as *E. pilosa;* Boone County, collector not given, October 14, 1898; Oronogo, *Palmer* 32713, September 4, 1897; Webb City, *Palmer* 32649, August 28, 1927; *Palmer* 32559, August 17, 1927; *Palmer* 32633, August 28, 1927; *Palmer* 26306, September 29, 1924, as *E. pilosa;* Bolivar, *Hoover*, 1899; Jackson County, *Bush*, September 14, 1890.

99. ERAGROSTIS MAJOR Host. 1809.

Columbia, *Daniels*, 1897, two sheets; Adair County, *Sheldon*, August 10, 1880, as *E. minor;* Jackson County, *Bush*, September 15, 1891; Columbia, *Saeger*, July 23, 1919; Boone County, collector not given, October 14, 1898; Clinton, collector not given, June 28, 1892.

100. ERAGROSTIS PECTINACEA (Michx.) Nees. 1829.

Columbia, *Daniels*, September, 1902, two sheets; *Daniels*, September 13, 1902; *Galloway*, August 1, 1884; *Saeger*, September 11, 1919; *Favor*, August 29, 1901; Boone County, collector not given, October 15, 1898; Webb City, *Palmer* 32626, August 20, 1927; Jackson County, *Bush*, August 13, 1890.

101. *Eragrostis trichodes* (Nutt.) Nash, 1895.

No specimens of this species under any name were found in the University collection from Boone County, but there is one as follows: Carroll County, *Bush*, September 18, 1890.

102 ERAGROSTIS HYPNOIDES (Lam.) B. S. P. 1888.

Columbia, *Daniels*, July, 1897; August, 1902; Rocheport, *Rickett*, September 22, 1929; S. E. Missouri, collector not given, 1900 as *E. Purshii;* Kennett, collector not given, July 23, 1900, as *E. Purshii;* Jackson County, *Bush*, July 17, 1889.

103. EATONIA OBTUSATA (Michx.) A. Gray, 1856.

Columbia, *Daniels*, May, 1897; Bolivar, *Hoover*, 1889, as *Koeliria cristata;* Webb City, *Palmer* 32368, June 15, 1927.

104. EATONIA PENNSYLVANICA (DC.) A. Gray, 1856.

Columbia, *Daniels*, May, 1897; *Daniels*, June, 1905, as *E. pennsylvanica Major; Daniels*, June, 1903; Jackson County, *Bush*, June 11, 1892; *Bush*, June 12, 1891, as *E. pennsylvanica major.*

104A. *Eatonia pennsylvanica major* Torr.

This variety is now regarded as the same as the specific form, of which it seems to be only a robust state.

105. *Koeleria cristata* (L.) Pers. 1805.

No specimens of this species under any name were found in the Daniels collection, but there are two collections in the Missouri collection as follows: Kingston, *Saeger*, July 17, 1919; Jackson County, *Bush*, June 16, 1892.

106. *Melica mutica* Walt. 1788.

No specimens of this species under any name were found in the University collection.

107. DIARRHENA AMERICANA Beauv. 1812.

Columbia, *Daniels*, August 1, 1902; *Saeger*, August 10, 1919; collector not given, July 29, 1886; Jackson County, *Bush*, September 10, 1891.

108 UNIOLA LATIFOLIA Michx. 1803.

Columbia, *Daniels*, July, 1897; *Daniels*, August 1, 1902; *Daniels*, September, 1903; *Favor*, September 6, 1901, two sheets; *Saeger*, July 19, 1919; *Rickett*, September, 1926; Oregon County, *Bush*, August 14, 1890.

109. DACTYLIS GLOMERATA L. 1753.

Columbia, *Daniels*, May, 1897; Jackson County, *Bush*, June 21, 1892.

110. *Poa annua* L. 1753.

No specimens of this species under any name were found in the Daniels collection, but there was one as follows: Columbia, *Saeger*, September 13, 1919.

111. POA PRATENSIS L. 1753.

Columbia, *Daniels*, June, 1903; *Rickett*, June 5, 1930, as *P. Chapmaniana*.

112. POA WOLFII Scribn. 1894.

Columbia, *Daniels*, June, 1897; *Daniels*, June, 1904; *Daniels*, July, 1903, two sheets; *Daniels*, June, 1903, as *P. alsodes; Daniels*, June, 1904, two sheets, as *P. alsodes; Daniels* May, 1905, as *P. alsodes*.

113. *Poa alsodes* A. Gray, 1856.

No specimens of this species under any name were found in the Daniels collection, or in the University collection from Missouri.

114. POA SYLVESTRIS A. Gray, 1848.

Columbia, *Daniels*, June, 1897; *Daniels*, June, 1905; Jackson County, *Bush*, June 2, 1892.

115. POA COMPRESSA L. 1753.

Columbia, *Daniels*, June, 1897; *Saeger*, June 18, 1920;

Jackson County, *Bush*, June 18, 1890; Greene County, *Weller*, June 28, 1890, as *P. arachnifera*.

116. POA CHAPMANIANA Scribn. 1894.

Columbia, *Daniels*, May, 1904; Jackson County, *Bush*, April 30, 1888, as *P. annua;* Greene County, *Weller*, May 5, 1890.

Glyceria fluitans (L.) R. Br. 1810.

No specimens of this species under any name were found in the University collection.

118. GLYCERIA NERVATA (Willd.) Trin. 1831.

Columbia, *Daniels*, May, 1897, two sheets; *Daniels*, July 7, 1903, two shets; *Rickett*, June 29, 1930; *Saeger*, June, 1920; Saint Louis County, *Eggert;* June 18, 1886, as *G. pallida;* Jackson County, *Bush*, June 8, 1892.

119. *Festuca ovina duriuscula* (L.) Hack. 1882.

No specimens of this variety or the specific form were found in the University collection, from Missouri.

120. *Festuca octoflora* Walt. 1788.

No specimens of this species under any name were found in the Daniels collection or from Boone County, but there are two collections as follows: Jackson County, *Bush*, May 29, 1884; *Bush*, June 5, 1891.

121.*Festuca elatior* L. 1753.

Columbia, *Daniels*, July, 1903, four sheets; *Daniels*, July 7, 1903; Jackson County, *Bush*, June 11, 1891; *Bush*, July 2, 1891; S. W. Missouri, *Hoover*, 1899.

121A. *Festuca elatior pratensis* A. Gray, 1867.

This variety is now considered as a mere form of *F. elatior*.

122. FESTUCA NUTANS Willd. 1809.

Columbia, *Daniels*, May, 1897; *Daniels*, July, 1903; *Daniels*, June, 1903; *Daniels*, June 13, 1903; *Duggar*, June 13, 1903; Jackson County, *Bush*, June 14, 1892; *Bush*, June 16,

1892; Shannon County, *Favor*, May 29, 1902, two sheets; *Favor*, May 27, 1902; *Favor*, date not given.

123. FESTUCA SHORTII Kunth, 1861.

Columbia, *Daniels*, July, 1903, four sheets; *Daniels*, July, 1904; Saint Louis, collector and date not given; Jackson County, *Bush*, July 6, 1892.

124. BROMUS INERMIS Leyss. 1761.

No specimen of this species under any name of Daniels' collecting were found in the University collection, but there is one as follows: Columbia, *Favor*, June 20, 1902.

125. *Bromus tectorum* L. 1753.

No specimens of this species under any name were found in the Daniels collection, or in the University collection from Missouri.

126. *Bromus ciliatus* L. 1753.

No specimens of this species under any name were found in the Daniels collection, or in the University collection from Missouri, and Missouri is far beyond the known range of this species.

127. BROMUS PURGANS L. 1753.

Columbia, *Daniels*, July 3, 1903; *Daniels*, 1897, as *B. ciliatus; Daniels*, July, 1904, as *B. ciliatus; Daniels*, June 22, 1903 as *B. ciliatus*.

128. *Bromus secalinus* L. 1753.

No specimen of this species so labeled by *Daniels* was found in the University collection, but there are three collections as follows: Columbia, *Daniels*, July 7, 1903, as *B. racemosus; Saeger*, June 1, 1920, the only specimen known from Boone County correctly identified; Jackson County, *Bush*, June 21, 1892.

129. *Bromus mollis* L. 1762.

No specimens of this species under any name were found in the *Daniels* collection, or from Boone County, but there is

one collection from Missouri as follows: Jackson County, *Bush*, June 5, 1891.

130. *Bromus racemosus* L. 1753.

No specimens of this species under any name were found in the Daniels collection, but there are two in the University collection as follows: Columbia, *Saeger*, May 27, 1920, as *B. arvensis;* Jackson County, *Bush*, June 11, 1891.

131. *Lolium perenne* L. 1753.

No specimens so named were found in the *Daniels* collection, but there were four collections as follows: Columbia, *Daniels*, July, 1904, as *L. italicum; Saeger*, May 27, 1920; Jackson County, *Bush*, July 8, 1891; *Bush*, July 11, 1891.

132. *Lolium italicum* A. Br. 1834.

No specimens of this species under any name were found in the Daniels collection, but there is one from Boone County as follows: Columbia, *Saeger*, July, 1927, as *L. multiflorum*.

133. AGROPYRON REPENS (L.) Beauv. 1812.

Columbia, *Daniels*, June, 1887; *Daniels*, July 5, 1903.

134. AGROPYRON SPICATUM (Pursh) S. & S. 1897.

Columbia, *Daniels*, July 3, 1903; *Daniels*, July 5, 1903, two sheets; Centralia, *Maneval*, June 21, 1920; Jackson County, *Bush*, June 6, 1892; *Bush*, June 20, 1892, as *A. repens*.

135. SECALE CEREALE L. 1753.

Commonly cultivated and adventive in many places and no doubt observed by Daniels.

136. TRITICUM SATIVUM VULGARE (Vill.) Hack.

Commonly adventitious in many places, and no doubt observed by Daniels.

137. HORDEUM SATIVUM HEXASTICHON (L.) Hack.

Commonly cultivated, and adventitious along railroads and in waste places, and no doubt observed by Daniels.

138. *Hordeum nodosum* L. 1753.

No specimens of this species were found in the University collection from Missouri.

129. *Hordeum jubatum* L. 1753.

No specimens of this species were found in the Daniels collection, but there is one from Boone County, as follows: Centralia, *Saeger*, June 20, 1920; Joplin, *Palmer* 25329, June 5, 1924; *Palmer* 32408, June 25, 1927.

140. ELYMUS STRIATUS Willd. 1797.

Columbia, *Daniels*, June, 1897; *Daniels*, July, 1903; Odessa, *Bush*, 11369, July 7, 1927; Reeds, *Palmer*, 33134, October 14, 1927; Joplin, *Palmer* 32418, June 25, 1927; *Palmer* 32479, July 12, 1927; Jackson County, *Bush*, July 8, 1890.

140A. *Elymus striatus villosus* A. Gray, 1848.

This form is not now considered distinct from the typical form.

141. *Elymus virginicus* L. 1753.

Columbia, *Daniels*, June 13, 1903; *Daniels*, July 3, 1903; Bolivar, *Hoover*, 1899, as *E. robustus;* Webb City, *Palmer* 32592, August 20, 1897; Joplin, *Palmer* 32429, June 30, 1927; Jackson County, *Bush*, June 29, 1891.

142. *Elymus canadensis* L. 1753.

No specimens of this species under any name were found in the University collection from Missouri.

143. *Elymus glaucifolius* Muhl. 1809.

No specimens of this species under any name were found in the Daniels collection, but there are two collections from Boone County, as follows: Columbia, *Saeger*, August 10, 1919; Lover's Leap, *Dickson*, August 16, 1927, as *E. virginicus*.

144. ASPRELLA HYSTRIX (L.) Willd. 1809.

Columbia, *Daniels*, July 13, 1903; *Saeger*, June 26, 1920; Boone County, *Favor*, June 22, 1902, three sheets; *Galloway*, July 30, 1883; Ozarks, collector and date not given.

In summing up the above it will be seen that five genera and forty-eight species and varieties have been unaccounted for; however, later collections have enabled me to restore three of Daniels genera, and fourteen species, and to add sixteen new species to the Boone County Flora.

The following list will bring the grass-flora up to date so far as is now known:

1. PASPALUM MUHLENBERGII Nash, 1901.

Columbia, *Daniels*, July 24, 1903, as *P. setaceum; Saeger*, August 27, 1919, as *P. stramineum;* Jackson County, *Bush*, August 24, 1891, as *P. setaceum*. Until some ten years after Daniels published his Flora, collections of this species were usually referred to as *P. setaceum*.

2. PANICUM HUACHUCAE Ashe, 1898.

An abundantly and extremely variable species, found throughout the State, and almost universally referred to *P. lanuginosum* of the southeastern States.

Columbia, *Daniels*, June, 1904, July 17, 1903, all as *P. implicatum; Daniels*, July 3, 1903, and July, 1903, as *P. dichotomum; Daniels*, July, 1903, as *P. dichotomum fasciculatum; Daniels*, June, 1904, as *P. lanuginosum;* Bolivar, *Hoover*, 1899, as *P. columbianum*.

3. PANICUM HUACHUCAE SILVICOLA Hitchc. & Chase, 1908.

Columbia, *Daniels*, July 13, 1903, five sheets, and July 4, 1901, two sheets, all as *P. implicatum; Daniels*, July 13, 1903, three sheets, and July 4, 1903, all as *P. dichotomum villosum; Daniels*, July 29, 1903, as *P. dichotomum fasciculatum; Daniels*, July, 1903, as *P. dichotomum; Daniels*, June, 1904, as *P. nitidum; Daniels* June 13, 1903, and June 1904, two sheets, all as *P. lanuginosum;* Shannon County, *Tracy*, July 2, 1886, as *P. dichotomum barbulatum;* Bolivar, *Hoover*, 1889, as *P. implicatum*.

4. PANICUM LATIFOLIUM L. 1753.

Columbia, *Daniels*, July, 1904, July 17, 1903, and July 13,

1903, all as *P. porterianum;* Columbia, *Daniels*, August, 1904, as *P.pubifolium;* Columbia, *Saeger*, May 1, 1920, as *P. Boscii;* Jackson County, *Bush*, June 19, 1884.

5. PANICUM SPHAEROCARPON Ell. 1817.

Columbia, *Daniels*, July, 1903, as *P. dichotomum fasciculatum;* Columbia, *Daniels*, July 7, 1903, July 5, 1903, two sheets, July 17, 1902, all as *P. commutatum;* Columbia, *Daniels*, June, 1903, and July 23, 1903, two sheets, all as *P. columbianum;* McDonald County, *Bush*, July 23, 1892; Shannon County, *Bush*, September 12, 1888, as *P. nitidum;* McDonald County, *Bush*, July 24, 1892, as *P. laxiflorum.*

6. PANICUM TENNESSEENSE Ashe, 1898.

Columbia, *Daniels*, July 13, 1903, as *P. implicatum;* Columbia, *Daniels*, June, 1903, as *P. columbianum;* Wright County, *Bush*, June 25, 1888, as *P. dichotomum barbinode;* Jefferson County, *Eggert*, June 3, 1887, as *P. consanguineum.*

7. PANICUM TSUGETORUM Nash, 1898.

Four simple culms are referred somewhat doubtfully to this species by Hitchcock as follows: Columbia, *Galloway*, August 1, 1884, as *P. depauperatum.* There is much doubt as to the locality, date and collector of these specimens, as Missouri is much outside of the known range of this species.

8. PANICUM XALAPENSE H. B. K. 1816.

Columbia, *Daniels*, June 13, 1903, as *P. lanuginosum.*

9. ARISTIDA DICHOTOMA Michx. 1803.

Columbia, *Daniels*, September 13, 1902, as *A. basiramea;* *Daniels*, September, 1904, as *A. basiramea;* Shannon County, *Bush*, September 14, 1888.

10. AGROSTIS SCHWEINITZII Trin. 1841.

Columbia, *Daniels*, July 13, 1903, as *A. hyemalis;* Butler County, *Bush*, November 3, 1892, as *A. perennans aestivalis;* Jefferson County, *Hasse*, May 24, 1887, as *A. arachnoides;* Jackson County, *Bush*, August, 24, 1891, as *A. perennans.*

11. ANDROPOGON VIRGINICUS L. 1753.

Columbia, *Saeger*, September 27, 1919; Webb City, *Palmer* 32728, September 15, 1927; Dunklin County, *Bush*, October 21, 1892.

12. MELICA NITENS Nutt.; Piper, 1905.

Columbia, *Daniels*, June, 1903, three sheets, June 17, 1902, June 13, 1903, June, 1897, all as *M. mutica; Galloway*, August 1, 1884, as *M. mutica; Saeger*, May 27, 1920, as *M. porteri;* Greene County, *Blankinship*, May 19, 1887, as *M. diffusa*.

13. BROMUS PATULUS M. & K. 1823.

Columbia, *Daniels*, June, 1903, July 7, 1903 and July 4, 1903, all as *B. hordeaceus; Saeger*, June 19, 1920, as *B. commutatus;* Webb City, *Palmer* 32363, June 5, 1927, and 32433, June 10, 1927, both as *B. arvensis;* Carthage, *Palmer* 21409, May 25, 1922, as *B. arvensis;* Melagin, *Palmer* 25301, June 4, 1924, as *B. arvensis*.

14. HORDEUM PUSILLUM Nutt. 1818.

Columbia, *Daniels*, May, 1897, as *H. pratense; Daniels*, June 17, 1902, as *H. pusillum; Saeger*, May 15, 1920, Jackson County, *Bush*, June 7, 1891. This species was known to Daniels and collected by him under this name, but for some reason it was omitted from his list, and it is new to Boone County.

15. ELYMUS GLABRIFLORUS (Vasey) S. & B. 1901.

Columbia, *Daniels*, June, 1897, as *E. striatus;* Shannon County, *Bush*, July 21, 1891, as *E. striatus*. Daniels apparently did not recognize this species which he had in hand, and it is new to Boone County.

16. ELYMUS HIRSUTIGLUMIS Scribn. 1898.

Apparently not seen by Daniels, as the only Boone County specimen I have seen is as follows: Columbia, *Saeger*, September 27, 1919.

NOTES ON NEW FORMS OF MALUS AND CRATAEGUS

ARTHUR D. SLAVIN

During the past twenty-five to thirty years, this Bureau has devoted much effort to the propagation of native and exotic plant material. As this work has progressed we have been continually on the lookout for variation in seedling material. The forms described here are, without exception, seedlings of species used for ornamental purposes, and it is not unlikely to believe that they will prove of even greater value for the same type of horticultural endeavor. Credit for their discovery goes to Bernard H. Slavin, Superintendent of the Rochester Parks.

Malus ioensis Britton forma **fimbriata** f. n.

A somewhat ascending narrow topped arborescent tree, 2.2 m. high and 1.6 m. wide. Branches at first horizontal, then ascending, bark smooth and dark gray except on main stem near the base, where it is scaly and much darker in color. Branchlets slender, tomentose when young, pubescent first year, color dark brown. Spurs 7-8.5 cm. long often terminating in spines. Spines 2.5-6 cm. long and sharp pointed. Leaves 5.7-11 cm. long and 1.6-2.5 cm. wide, oblong lanceolate, acute, cuneate or sometimes obliquely rounded at the base, floccose tomentose below and glabrous on the surface, at maturity generally pubescent or slightly tomentose below, serrate, lobes small, incise and often indistinct, slender midrib and primary veins. Leaves on vegetative branches larger, oblong ovate and more deeply lobed, floccose tomentose on the underside throughout the season and much coarser in structure. Flowers double, 3.8-5 cm. in diameter, generally in clusters of five; pedicels villose, 1.3-4 cm. long; calyx covered with hoary tomentum; lobes lanceolate; petals (25-30) obovate, fimbriate on the margins, color blush white to light pink.

Styles 5, united at the base and covered for one-third their length with tufted hairs. No fruit has ever been found on this plant.

Genesee Valley Park, Rochester, New York (type)
Bernard H. Slavin No. 6, June 3, 1929, A. D. Slavin, Flowering specimens, May 24, 1930.

This plant differs principally from the related form *M. ioensis plena* (Bechtels Crab) by its fimbriate petals, spiny spurs, its narrow form of growth and more ascending branches. The leaves are also different. In the form described here they are lanceolate rather than elliptic. The flowers in addition to having fimbriate petals are slightly larger than in the variety *plena*. In color and abundance they surpass any known American crab. A mature specimen of this plant may be expected to attain a height even greater than the straight species because of its narrow habit due to the ascending tendency of the branches.

Malus coronaria Miller forma **nieuwlandiana** f. n.

Arborescent 3 m. high and 3.9 m. wide. Branches dense, stout, glabrous and horizontal becoming ascending towards the top of the tree; bark dark gray, on main stem much darker and scaly towards base. Branchlets tomentose at first, then glabrous, color chestnut brown. Leaves 4.5-9 cm. long and 3.2-4.7 cm. wide, ovate to oblong ovate, those on vigorous branches generally more ovate than on fertile shoots; base rounded, apex acute to acuminate, floccose-tomentose when young, finally glabrous; lobes 5-6 pairs, rather indistinct often appaering as incise serrations, serrate; petioles 1.5-2.5 cm. long, pubescent and colored red at maturity. Flowers semi-double, 3.1-4.5 cm. in diameter, generally in clusters of five; pedicels 3-5.5 cm. long, slender, glabrous and sometimes slightly villose towards the base; calyx tomentose inside, villose outside, lobes lanceolate, acuminate; petals (12-18) obovate to suborbicular and narrowed towards the base into a

long claw, color blush white to light pink, striated towards the base with crimson veins; anthers rose; styles five. Fruit on slender pedicels, 3-5.5 cm. long, color light green at maturity, very depressed globose in shape, 4.2-5 cm. in diameter, waxy and fragrant at maturity.

Durand Eastman Park, Rochester, New York, (type) Bernard H. Slavin, No. 4, June 7, 1928. September 24, 1928. A. D. Slavin, May 21, 1930.

This form was found among a group of seedlings of *M. coronaria* which were raised some years ago for future planting in the parks of Rochester. Comparison with other forms of the parent brought out many interesting differences. This small tree which is now making its best growth is quite broad, measurements showing it to be one-third wider than high. The leaves are more elongated than in the straight species. The flowers which are an important feature of this form, are not only double but also have long slender pedicels which permit the flowers to hang in graceful nodding clusters. In comparison with *M. coronaria* var. *Charlottae*, another double flowering form of the same species, the pedicels are at least twice as long, and although the flowers of both form are equal in size, the color of the form described here is much brighter. The fruit which is large and flat in shape is very distinct. The color remains quite green in the fall, whereas in the species it becomes a yellowish green. A noteworthy feature is its marked fragrance. Experiments made to determine its value for use as an edible jelly have proven most satisfactory. That it has high pectin content is evident by the ease with which it "jells." The result is a clear yellow jelly with a peculiar but very pleasant tasting quality. I have named this plant for my former professor, the Rev. J. A. Nieuwland of the University of Notre Dame, noted for his research work in the fields of systematic botany and organic chemistry.

Crataegus phaenopyrum Medicus forma **fastigiata** f. n.

A small columnar tree, 3.8 m. high and 1.8 m. wide. Branches dense, fastigiate, breaking from the main stem about three and a half decimeters above the base; bark glabrous, color olive gray; branchlets slender with a shining chestnut brown color. Spines numerous, slender, and 3-6.5 cm. Leaves 4-7 cm. long and 2.7-6 cm. wide, broad or triangular ovate, truncate, cuneate and often rounded at the entire base; lobes 3-5 pairs, acute to acuminate, crenate serrate, in many cases they appear as deep incise serrations rather than lobes; surface bright green and slightly pubescent on the midrib, underside of leaf lighter green and glabrous. Petiole 1.3-2.3 cm. long, stout and glabrous. Flowers 4-7 mm. in diameter, born in corymbs of about twenty flowers; calyx broad obconic, lobes acute, short, glabrous outside, pubescent inside, ciliate on the margins; anthers cream color; styles 2-5, surrounded at the base by tufts of hair. Fruit 4-6 mm. in diameter, persistent, slightly depressed globose, small and colored lustrous scarlet; calyx deciduous from ripe fruit leaving apex of nutlets exposed. Flesh thin. Nutlets 3-4 mm. long, acute at base and rounded at apex.

Durand Eastman Park, Rochester, New York (type) Bernard H. Slavin, No. 22, October 26, 1928, June 26, 1929.

This plant is, to my knowledge, the first proven example of a direct break in any of our native *Crataegus*. Unlike the straight species *Crataegus phaenopyrum* (C. cordata) commonly known as the Washington Thorn, it is distinctly columnar in shape, which feature, accompanied by its small flowers and fruit, makes it most easy to recognize. Due to the fact that it has all the good qualities of the parent, which itself is one of the most popular species of the genus for ornamental work, this form should, because of its individual characteristics, also be of value for horticultural work.

Bureau of Parks,
Rochester,
New York.

BOOK REVIEWS

HANDBOOK OF PROTOZOOLOGY, by Richard Roksabro Kudo. Springfield, Ill., Charles C. Thomas, 1931. viii + 451 pp. $5.50

In the nature of things, most paleontologists and geologists find their acquaintance with the Protozoa limited to *Amoeba* and *Paramoecium*, (which many of them recall only from the remote days of Zoology 1 or General Biology), to the Radiolaria, and to Foraminifera. Matters are not improved by the fact that in too many university curricula, protozoology is a subject for the premedical student or the graduate in zoology. This situation is reflected in most textbooks of the subject, which lay chief stress upon pathologic and other parasitic forms, but slight the free-living Protozoa.

The chief value of the present *Handbook* lies in the fact that it presents a general survey of the phylum Protozoa. Three excellent, concise, clearly written chapters deal with the history and relationships of protozoology, and with the morphology, physiology and reproduction of the animals. For the person who wants an introduction to and the summary of protozoan biology less elaborate than Calkins' *Biology of the Protozoa*, nothing better is available.

The following thirty chapters deal with taxonomy of the phylum, although notes on habits, relationships and distribution are included in the treatment of each group. There are keys for the determination of classes, orders and families, and brief characterizations of important genera. No elementary textbook of paleontology presents a more usable survey of the orders of Foraminifera and Radiolaria than does Dr. Kudo's *Handbook;* and although the paleontologic specialist may find it of little practical value, he will be glad that other orders with which he is less familiar receive equally clear treatment.

In fact, it is as a general survey of a phylum in which his interest is unfortunately limited by preserved material, that the paleontologist will make chief use of Dr. Kudo's volume. Its clear, compact organization, its hundreds of excellent line drawings, its summary of literature which in the original form is beyond the reach of most paleontologists will make it a one-volume background for both the multitude of papers describing individual groups or faunas, and for general handbooks of Foraminifera, such as that of Cushman. For such use, the firm binding and thin paper — the total thickness of the book is only 26 millimeters — give this *Handbook of Protozoology* the further virtues of durability and convenience.—Carroll Lane Fenton.

AQUATIC MAMMALS, by A. Brazier Howell. Springfield, Ill., Charles C. Thomas, 1930. x + 332 pp. $5.00.

Everyone is agreed that such varied animals as the whale, the otter, the beaver and the duckbill possess structures and habits which mark them as water dwellers. Occasionally those habits are summarized in discussions of natural history, or the structures reviewed in summaries of adaptation. Perhaps we go farther, including the fish, ichthyosaur and porpoise as examples of convergence — a phenomenon which may be dealt with from viewpoints as varied as those of Samuel Butler and Osborn. But for the most part we take aquatic adaptations for granted, and it is not surprising that few if any attempts have been made to summarize the structures of water-dwelling mammals as a basis for generalization.

It is this task which Mr. Howell has set himself in the volume at hand. His outlook upon the problem of aquatic adaptation is well shown by two quotations from Jennings which open his Introduction: that "under the same conditions objects of different material behave diversely; under diverse conditions objects of the same material behave diversely," and that "neither the material constitution alone, nor the condi-

tions alone, will account for any even whatever; it is always the combination that has to be considered." Two of the diverse conditions with which Mr. Howell is forced to deal are the terrestrial and the aquatic environment, while the diverse materials involve a wide range of vertebrate organisms.

Chapter I presents a fifteen page analysis of the mechanics of swimming — an analysis which involves other animals than mammals. There is a slip here which is quite obvious —so plain that it naturally was overlooked in proof-reading —which puts the frogs and toads into the class Reptilia. Those of us whose lot it is to worry over slips of typography in periodicals may take some consolation from such an error in so well printed a volume as *Aquatic Mammals.*

Chapter II presents a review of aquatic mammals which may be used as a superior substitute for the one appearing in some of the more recent natural histories. It is a chapter which I shall consult often, along with Chapter III, which presents a summary of external features of varied types of aquatic mammals. Mr. Howell evidently does not believe in writing in haste, or with too much condensation. His method suggests the recent remark of Professor E. B. Wilson, that "to take a subject twice from different angles and thus better master the whole might be far better in building a scientific life than to be forever going on to some new subject, leaving everything both new and old with insufficient consolidation." The rule which Professor Wilson thus suggests applies also to building a scientific book — especially if it deals with subjects that have been taken for granted.

The succeeding nine chapters deal with specific functions and parts — the senses, the skull, the tail, and so on. To review them would be to write a hasty essay paralleling the book; an undertaking that obviously would be superfluous. Suffice it, then, that I find each chapter interesting and informing, while as a paleontologist, I note that Mr. Howell gives due attention to fossil as well as modern skeletal material. His treatment of the difficulties encountered when one

seeks to trace descent from such specimens has none of the attitude recently shown by Professor Radl, when in his *History of Biological Theories* he suggests that paleontologists stress the imperfections of the fossil record as a means of excusing lack of discovery. Mr. Howell knows better than that — and he shows that the zoological record is not always adequate. Paleontologists who envy their colleagues in anatomy will find that feeling reduced by Mr. Howell's frequent references to the difficulty of procuring specimens worth dissecting.

Popularly, the great significance of aquatic mammals lies in their remarkable adaptation: an adaptation which has reversed much that seems typically mammalian. As one reads these chapters the question of cause appears again and again. But it is not always answered, to the great profit of the book, for such answers would have caused it to degenerate into a mere neo-Lamarckian survey. It is true that Mr. Howell subscribes to a modified form of the doctrine of inheritance of the effects of use and disuse, but he does not allow his opinion to distort his presentation, nor does he hold to it alone. "The writer is strongly convinced," he says, "that we cannot look to any one theory to explain evolution. The whale is very different indeed from the generalized type of mammal in a great many major details, and hundreds and even thousands of minor details, involving billions of cells. These items have been changed . . . by numberless evolutional stimuli, some simple and others complex . . ." With this conclusion one must be in accord unless, like the followers of Wallace, he believes that there is one, and only one *causa vera* of organic change. But that belief the present reviewer, whose studies have led to a theory very different from that of Mr. Howell, does not share — even with regard to his own theory. It is pleasant to find that in this, the first comprehensive survey of aquatic animals, doctrines explaining adaptations which are among the most remarkable in all nature do not intrude. —Carroll Lane Fenton.

THE GENETICAL THEORY OF NATURAL SELECTION, by R. A. Fisher. pp. 268. Oxford University Press, New York. $6.00.

Modern biology no longer conceives of natural selection as a causative agent in evolutionary advance, but simply as a sieve which picks out the successful survivors in a given environment. This view-point is altogether in line with the author's mathematical treatment of it as an independent principle, one phase of whose operation we see in the evolutionary process, but where its application in the past has largely concealed its real universality. Chapters on the fundamental theorem of natural selection, evolution of dominance, variation, sexual reproduction and selection prepare us for the second half of the book, where the author considers the sociological aspects of his theory. Here fertility and reproduction in relation to the conditions for a permanent civilization constitute the central theme.

Human societies from very early times have adopted an economic system for individualizing property, which might have been expected to control intra-communal selection along socially advantageous lines. However, the logical effects have not been realized, largely because of the inversion of the birth rate. This has been the consequence of (1) the inheritance of the physical and psychological characters determining reproduction (2) the social promotion of the less fertile. Thus the higher birthrate among the poor is increasing and this difference even extends to the bottom of the social scale as seen by the contrasting birth rates of semi-skilled and unskilled laborers. Various theories which have sought in wealth a cause of infertility have missed the point that infertility is an important cause of wealth. These causes must have been operative in the most ancient civilizations, the same causes acting upon each conquering people in turn. At the other extreme, among certain uncivilized peoples characterized by a tribal organization, etc., the more eminent are certainly the more fertile and here the effects of natural selec-

tion are greatly enhanced by social and sexual selection. The group of qualities understood by these barbarian peoples as associated with heroism, has been developed considerably beyond the optimum of individual advantage.

On the basis of such facts, the author shows that a redistribution of births would be attended by economic advantages, for a moderate social promotion of fertility is not incompatible with the economic organization of our civilization. The system of family allowances adopted in France is considered inadequate to preserve the higher level of intellectual ability. A permanent civilization might be established on a more complete system. Only a people capable of deliberate and intentional policy can hope to solve the problem of existing population, graded both in social ability and ineffective fertility.—N. M. Grier.

LIVING AFRICA, A GEOLOGIST'S WANDERINGS THROUGH THE RIFT VALLEYS, by Bailey Willis. Whittlesey House (McGraw-Hill Book Co.), 1930. xv + 320 pp. $4.00.

Bailey Willis, veteran geologist and geological explorer, here tells the story of six thousand miles of travel through east-central Africa in a study of the famous Rift Valleys. The book manages to convey in non-technical language a considerable amount of scientific information which even the geologist will not readily find elsewhere. At the same time it tells the story of a country which is almost the last frontier, -- a country which most of us know only through the writings of Akeley or the admirable moving pictures of Martin Johnson, — and does so in a way which is bound to attract anyone who enjoys a good travel story, whether he is interested in geology or not. For Bailey Willis is not alone a geologist: he is a capable painter, a skilled writer, a commentator rich in experience gleaned in various byways of the world.

That work, as detailed in the present volume, involved an examination of the two great systems of fault or rift valleys which run from Lake Rudolph past Lake Eyasi, and from Lake Albert to the southern end of Lake Tanganyika, with the broad basin of Lake Victoria between them.

Suess, in accordance with his general doctrine of continental foundering or *Einbruch*, pictured the Rift Valleys as elongate strips or blocks which dropped from arches formed by a shrinking earth. The arches themselves were one phase of depression; the broad plateus bordering the Rifts were drained by sinking of the sea, and not by uplift. The general doctrine is familiar to everyone in its connection with theories of lost or "foundered" continents, which still appear in some standard textbooks of geology.

But Gondwanaland and Lemuria are losing their popularity, even in the field of biogeography, while continental foundering of a sort that leaves plateus and mountains sixteen thousand feet high seems highly questionable. This much we grant before reading Willis; and when he shows us that those plateus preserve the physiography of mature or senile lowlands we feel more secure in our skepticism. He shows, moreover, that the streams of those lowlands have been markedly disturbed in relatively recent geologic time, by movements which seem to have produced the rifts and the plateus. Many streams which once drained to the Congo now are tributary to the Nile; rivers whose upper courses are sluggish, debouche through obviously young ravines. These facts, plus others gathered from examination of the actual fault scarps show that the region of the rifts has been uplifted.

But if this is so, why the valleys? What combination of stresses has produced highlands and trenches such as the one occupied by Lake Tanganyika, whose bottom lies sixteen hundred feet below sea level?

Gregory, working in the eastern or Great Rift Valley, accepted the hypothesis of Suess that there once was a con-

tinent, to be known as Gondwanaland, which occupied the northern part of the Indian Ocean, and connected Africa with India and Australia. Subsiding, that continent tore both Africa and Arabia, producing a rent reaching from Zambesi to the Jordan. The Rift Valleys, in this interpretation, are portions of that irregular, multiple rent, — key blocks foundered when the earth broke and spread. Lake Tanganyika, bordered by plateus, but with waters four thousand feet deep and a bottom sixteen hundred feet below sea level, seems to be an even better illustration of Gregory's hypothesis than is the region in which he worked.

Wayland, studying the Lake Albert Trough and Mt. Ruwenzori, reached strikingly different conclusions. He could not interpret the steep escarpments which "face each other across Lake Albert as fractures between which a keystone had sunk down . . . Wayland could not thus account for the high plateus between which Lake Albert lies, nor for the elevation of Mt. Ruwenzori [more than sixteen thousand feet], a mountain block which is part of the same zone. The plateus and Ruwenzori have been forced up. The block under Lake Albert, he reasoned, has been forced down. The whole great structure is a result of horizontal compression acting on wedge-shaped masses. The upper ones have risen on inclined planes; the under ones have been depressed by weight and pressure."

Willis offers two explanations for this, one of which fits only a comparative few of the rift valleys which have abrupt scarps on one side and gradual slopes on the other. In these he finds ordinary unequal elevation, with breaking of the rocks most seriously strained, and bending of the others. The breaking is facilitated by the fact that the planes of parting in the old or "foundation" rocks stand on end, so that they yield readily to slipping.

The Western Rift, however, shows evidence of horizontal compression, with resulting uplift of mountain blocks whose vertical section seems to be wedge-shaped. It curves about

the basin of Lake Victoria, and is matched by the Eastern Rift, whose great volcanoes testify to the amount of molten rock which has been forced upward. If, as both Willis and Wayland have shown, the high lands have been elevated by compression, that force must have compressed the heights against the central area which contains Lake Victoria), or must have radiated outward from that area. Willis chooses the latter view, and closes his book with a discussion of recrystallization which might have caused the expansion of the Victoria Disc, a mass of rocks four hundred fifty miles in diameter in thickness, in such a way as to elevate the wedges first described by Wayland.

This review does not concern itself with the merits or demerits of the hypothesis. The reviewer prefers, therefore, to close with the appraisal with which he began: that *Living Africa* is a delightful book, in typography as well as in substance, and a valuable introduction to some of the concerns and procedures of geologic field work.—Carroll Lane Fenton.

STRASBURGER'S TEXT-BOOK OF BOTANY. By Hans Fitting, Hermann Sierp, Richard Harder, and George Karsten. Sixth English Edition. Translated from the Seventeenth German Edition by W. H. Lang, Manchester. 8vo. pp. xi+799. figs. 833. MacMillan and Company, 1930. $9.00.

It is about ten years since the last English edition of this famous textbook appeared, while the German original has undergone several important revisions which terminated with the latest, or eighteenth, edition, issued early in 1931. Not only has the text been thoroughly revised and brought up to date but many figures, charts and drawings have also been added. Hence its pedagogical standard has been kept at its classical height. The Index of Literature had to be reduced by listing only the very best and carefully selected publications, thus offering to every reader a comprehensive bibliography of what is to be considered the essence of

present-day botanical knowledge. The organization of the book, as established by Strasburger himself, has always been its strength on account of the clear and logical manner of its presentation and its confinement to Pure Botany. While we are used to find in the average botany textbook the attempt of attacking the subject by taking up simultaneously the structure and functions of the various organs of a plant, Strasburger's Text-Book is divided into two principal parts of which the first (General Botany) deals with morphology and physiology; the second (Special Botany), comprises a systematic survey of the whole plant kingdom. Thus the preceding study of morphology in its various branches will form a sound basis for understanding all the manifold processes taking place within the individual plant. The second part of the book presents a "Natural System" which resulted from the latest studies, suggestions and possible conclusions, proposed by various authors. The most noticeable difference from the previous German edition is the taxonomic treatment of the Angiospermae. While in that edition the results of the serodiagnostic method had been the aim in the systematic arrangement this "Koenigsberg phylogenetic tree," developed by Mez and his school, was not adopted in the present edition. Instead of this still very disputable system the author combined one of his own, accepting features that others have previously proposed and based principally on comparative morphological studies. Professor W. H. Lang has replaced the official plants of the German-speaking countries with the corresponding ones of the Britise Pharmacopoeia. The American teacher may easily substitute the representative species of the United States. The MacMillan Company is to be congratulated for the presentation of this standard textbook in its latest form to the English-speaking world and for the excellent workmanship manifested in this edition. The work will prove indispensable to every botanist and will win as many new friends as it has gained during the past thirty-six years since its first appearance.—Th. Just.

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